U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: COMPLIANCE WITH ICING REQUIREMENTS OF §§ 25.1419(e), (f) and (g) And 25.1420	**Date:** Draft 05/3/01	**AC No: 25-XX**
	Initiated By: ANM-110	**Change:**

WORKING DRAFT -- NOT FOR PUBLIC RELEASE.

1. PURPOSE.

a. This Advisory Circular (AC) describes an acceptable means for showing compliance with the requirements of § 25.1419(e), (f) and (g), "Ice Protection," and § 25.1420, "Exit large droplet conditions," of Title 14, Code of Federal Regulations (14 CFR) part 25, commonly referred to as part 25 of the Federal Aviation Regulations (FAR). Part 25 contains the applicable certification requirements for transport category aircraft. The means of compliance described in this document are intended to provide guidance to supplement the engineering judgment that must form the basis of any compliance findings relative to the requirements of §§ 25.1419(e), (f) and (g) and 25.1420. Guidance includes considerations for :

- installing a primary ice detection system;
- developing a method to alert the flightcrew that the airframe ice protection system must be activated and revising the Airplane Flight Manual (AFM) concerning procedures for activating the airframe ice protection system; and
- a means for the flightcrew to determine that they must exit icing conditions.

b. The guidance provided in this document is directed to airplane manufacturers, modifiers, foreign regulatory authorities, and Federal Aviation Administration airplane type certification engineers and their designees.

c. Like all advisory circular material, this AC is not in itself mandatory, and does not constitute a regulation. It is issued to describe an acceptable means, but not the only means, for demonstrating compliance with the requirements for transport category airplanes. Terms such as "shall" and "must" are used only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described in this document is used. While these guidelines are not mandatory, they are derived from

extensive Federal Aviation Administration and industry experience in determining compliance with the pertinent regulations.

d. This advisory circular does not change, create any additional, authorize changes in, or permit deviations from regulatory requirements.

2. APPLICABILITY. The guidance provided in this AC applies to certification of part 25 transport category airplanes for flight in icing conditions.

3. RELATED DOCUMENTS.

a. **Regulations contained in Title 14, Code of Federal Regulations (CFR).**

Section	Title
§ 25.1301	Equipment - Function and installation
§ 25.1309	Equipment, systems, and installations
§ 25.1316(b)	System lightning protection
§ 25.1321	Instruments Installation - Arrangement and visibility
§ 25.1322	Warning, caution, and advisory lights
§ 25.1333	Instrument systems
§ 25.1419	Ice protection
§ 25.1420	Exit large droplet conditions
§ 25.1585(a)(6)	Operating procedures
Appendix C to part 25	

b. **Advisory Circulars (AC).** The AC's listed below may be obtained from the U.S. Department of Transportation, Subsequent Distribution Office, SVC-121.23, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785:

Number	Title and Date
AC 20-73	Aircraft Ice Protection, dated April 21, 1971.
AC 20-117A	Hazards Following Ground Deicing and Ground Operations in Conditions Conducive to Aircraft Icing, dated December 17, 1982.

AC 20-115B	Radio Technical Commission for Aeronautics, Inc. (RTCA) Document RTCA/DO-178B, dated January 11, 1993.
AC 21-16D	RTCA Document DO-160C, dated July 21, 1998.
AC 25-7A	Flight Test Guide for Certification of Transport Category Airplanes, dated March 31, 1998.
AC 25-11	Transport Category Airplane Electronic Display Systems, dated July 16, 1987
AC 25.1309-1A	System Design Analysis, dated June 21, 1988.
AC 25.1419-1	Certification of Transport Category Airplanes for Flight in Icing Conditions, dated August 18, 1999.

c. **Other FAA Documents:**

Number	Title
DOT/FAA/CT-88/8-1	"Aircraft Icing Handbook," issued March 1991, updated September 1993

d. **Industry Documents.** The following documents can be obtained from Radio Technical Commission for Aeronautics (RTCA), Inc., 1140 Connecticut Ave., NW, Suite 1020, Washington, DC 20036.

Number	Title
RTCA/DO-178B	Software Considerations in Airborne Systems and Equipment Certification
RTCA/DO160D	Environmental Conditions and Test Procedures for Airborne Equipment

4. DEFINITION OF TERMS. For the purposes of this AC, the following definitions should be used.

a. **Advisory ice detection system:** An advisory system annunciates the presence of icing conditions or ice accretion. The flightcrew is responsible for monitoring the icing conditions or ice accretion as defined in the AFM, typically using total air temperature and visible moisture criteria, visible ice accretion, or specific airframe ice accretion thickness, and activation by the flightcrew of the anti-icing or de-icing system(s) remains a requirement. The advisory system provides information to advise the flightcrew of the presence of ice accretion or icing conditions, but it can only be used in conjunction with other means to determine the need for, or timing of, activating the anti-icing or de-icing system.

b. **Airframe icing:** Ice accretions on portions of the airplane, with the exception of the propulsion system, on which supercooled liquid droplets may impinge.

c. **Anti-Icing:** The prevention of ice formation or accumulation on a protected surface, either:

- by evaporating the impinging water or
- by allowing it to run back and off the surface or freeze on non-critical areas.

d. **Automatic cycling mode:** A mode of operation of the airframe de-icing system that provides repetitive cycles without the need for the pilot to select each cycle. This is generally done with a timer, and there may be more than one timing mode.

e. **Deicing:** Removal or the process of removal of an ice accretion after it has formed on a surface.

f. **Irreversible flight controls:** All of the force required to move the pitch, roll, or yaw control surfaces is provided by hydraulic or electric actuators, the motion of which is controlled by signals from the flight deck controls. Loads generated at the control surfaces themselves are reacted against the actuator and its mounting and cannot be transmitted directly back to the flight deck controls.

g. **Large droplet conditions conducive to ice accumulation aft of the airframe's protected area:** Conditions containing a population of supercooled droplets sufficiently larger than those provided for in appendix C (of 14 CFR part 25) to cause ice accretions aft of the protected areas. The accumulation mechanism aft of the protected surface may be by direct impingement and accretion or delayed freezing of large droplets that impinge further forward. These conditions may be aircraft-dependent as a consequence of the geometry of the airfoil and the limits of protected areas.

h. **Monitored Surface:** The surface of concern regarding ice hazard (for example, the leading edge of the wing).

i. **Primary ice detection system:** The means used to determine when the IPS must be activated. The system annunciates the presence of ice accretion or icing conditions and may also provide information to other aircraft systems. A primary automatic system automatically activates the anti-icing or de-icing systems. With a primary manual system, the flightcrew activates the IPS upon indication from the system.

j. **Reference Surface:** The surface where an ice detection sensor is located or where a visual cue is located remotely from the surface of concern regarding ice hazard (for example, a propeller spinner).

k. **Reversible flight controls:** The flight deck controls are connected to the pitch, roll, or yaw control surfaces by direct mechanical linkages, cables, or push-pull rods such

that pilot effort produces motion or force about the hinge line. Conversely, force or motion originating at the control surface (through aerodynamic loads, static imbalance, or trim tab inputs, for example) is transmitted back to flight deck controls.

(1) Aerodynamically boosted flight controls: Reversible flight control systems that employ a movable tab on the trailing edge of the main control surface linked to the pilot's controls or to the structure in such a way as to produce aerodynamic forces that move, or help to move, the surface. Among the various forms are flying tabs, geared or servo tabs, and spring tabs.

(2) Power-assisted flight controls: Reversible flight control systems in which some means is provided, usually a hydraulic actuator, to apply force to a control surface in addition to that supplied by the pilot to enable large surface deflections to be obtained at high speeds.

l. **Static air temperature:** The air temperature as would be measured by a temperature sensor not in motion with respect to that air. This temperature is also referred to in other documents as "outside air temperature," "true outside temperature," or "ambient temperature."

m. **Substantiated visual cues:** Ice accretion on a reference surface identified in the Airplane Flight Manual (AFM) that is observable by the flightcrew. (NOTE: Visual cues used to identify ice addressed in Appendix C will differ from those used to identify large droplet ice.)

NOTE: These definitions of terms are intended for use only with respect to §§ 25.1419(e),(f) and (g), and 25.1420.

5. COMPLIANCE WITH § 25.1419(e)(1) and (e)(2).

a. **Requirements of the Rule.** This section of the rule requires either a primary ice detection system, or substantiated visual cues and an advisory ice detection system, to alert the flightcrew that the airframe ice protection system must be activated.

(1) One of the following provides an acceptable means of compliance with § 25.1419(e)(1):

- A primary manual ice detection system that provides an alert that the airframe ice protection system must be activated, or
- A primary automatic ice detection system.

(2) Substantiated visual cues, in conjunction with an advisory ice detection system, is an acceptable means of compliance with § 25.1419(e)(2). The visual cues can

range from direct observation of ice accretions on the airplane's protected surfaces to observation of ice accretions on reference surfaces. Examples of visual means could be:

- accretions forming on the windshield wiper posts,
- accretions forming on propeller spinners,
- accretions forming on radomes,
- accretions on the protected surfaces

If accretions on the protected surfaces cannot be observed, consideration should be given to providing a reference surface which can be periodically de-iced to allow better observation of the rate of ice accretion.

(a) *Field of View.* The visual cue should be developed with the following considerations:

(i) Visual cues should be within the flightcrew's vision scan area while seated and performing their normal duties.

(ii) The visual cue should be visible during all modes of operation (day, night).

(b) Verification. During the certification process, the applicant should verify the ability of the crew to observe the visual cue and reference surface. The visual cue should not be dependent upon the location of the flightcrew's seats. The visual cue should be evaluated from the most adverse flightcrew seat locations in combination with the range of flightcrew heights. The visual cues should be visible from both the left and right seats. Consideration should be given to the difficulty of observing clear ice. If a reference surface is used, the applicant should validate that it correlates with ice accumulation on the airframe's protected areas. Such visual cues should be validated by testing in measured natural icing.

(3) The applicant should present an icing certification plan, as suggested by AC 25.1419-1, to the cognizant Aircraft Certification Office. The plan should include the ice detector system's compliance with §§ 25.1301, 25.1309, 25.1419, and any other applicable sections.

b. **System Performance when Installed.** The applicant should accomplish a droplet impingement analysis and/or tests to ensure that the ice detector is properly located. The detector and its installation should minimize nuisance warnings.

c. **System Safety Considerations.** The applicant should consult AC 25.1309-1A for guidance on compliance with § 25.1309. In accordance with the AC, the applicant should accomplish a functional hazard assessment to determine the hazard level associated with failure of the ice detection system. The unannunciated failure of a primary ice detection

system is assumed to be a catastrophic failure condition, unless the characteristics of the airplane in icing conditions without activation of the airframe ice protection system(s) are demonstrated to result in a less severe hazard category. If visual cues are primary, failure of an advisory ice detection system is considered to be minor.

d. **Software and Hardware Qualification.** For guidance on hardware and software qualification, the applicant should consult RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification," and RTCA/DO160D, "Environmental Conditions and Test Procedures for Airborne Equipment."

e. **Safe Operations in Icing Conditions.**

(1) Section 25.1419 requires that the applicant demonstrate that the airplane is able to operate safely in the icing conditions defined in Appendix C to part 25. The ice detection system should be shown to operate in the range of conditions defined by Appendix C.

(2) Section 25.1419 also requires a combination of tests and analysis to demonstrate the performance of the ice detector and the system as installed on the airplane. This could include icing tunnel and icing tanker tests to evaluate the ice detector performance. Also required are analysis and flight tests in measured natural atmospheric conditions to demonstrate satisfactory performance of the system as installed on the airplane. It should be demonstrated that the airplane can be safely operated with the ice accretions formed at the time the ice protection system becomes effective, following activation of the ice detector.

f. **Airplane Flight Manual (AFM).** The AFM should address the following:

(1) Operational use of the in-flight ice detection system and IPS and any limitations; and

(2) Failure indications and appropriate crew procedures.

(3) Procedures for deactivating the IPS

6. COMPLIANCE WITH § 25.1419(e)(3)

a. **Requirements of the Rule.** This section of the rule provides an alternative to the primary ice detection system and the visual cues plus advisory ice detection system as defined in paragraph (e)(1) and (2). This alternative requires the operation of the ice protection system when the airplane is in conditions conducive to airframe icing during all phases of flight. If the ice protection system requires repeated cycling, an automatic cycling system must be provided.

b. The temperature cue used in combination with visible moisture should consider static temperature variations due to local pressure variations on the airframe. A minimum temperature limitation may be required on some types of systems due to equipment temperature limitations (such as elastomer pneumatic de-ice boot systems).

c. If this provision is used, the flightcrew should be able to easily determine the static air temperature. A display of static air temperature or a placard can be provided showing corrections for temperature vs. air speed to the nearest degree Centigrade in the region of interest (i.e., around 0° C). Requiring the flightcrew to access hand-held charts or calculators in lieu of a placard is not an acceptable means.

d. The limitations section of the AFM should identify specific static or total air temperature and visible moisture conditions which must be considered as conditions conducive to airframe icing, and should specify the phases of flight in which the IPS must be operated when these conditions are encountered.

7. COMPLIANCE WITH § 25.1419(f)

a. **Requirements of the Rule.** This section requires that if the ice protection system requires repeated cycling after initial activation:

(1) the airplane must be equipped with a system that automatically cycles the ice protection system, or

(2) an ice detection system must be provided to alert the flight crew each time the ice protection system must be cycled.

Some examples of systems which automatically cycle the IPS are:

1. A system that senses ice accretion on a detector and correlates to ice accretion on a protected surface. This system then cycles the IPS at a predetermined condition.
2. A system which cycles the IPS based on the use of a timer. Such a system may have more than one cycling time.
3. A system that directly senses the ice thickness on a protected surface and cycles the IPS.

The common attribute of all these systems is that the pilot is not required to manually cycle the IPS after initial activation.

Some examples of an ice detection system which alerts the flight crew each time the ice protection system must be cycled could be the same as 1 and 3 above, except that the

system alerts the crew each time the IPS must be manually cycled. A timer that does not have ice sensing capability cannot be used to meet this requirement.

b. **System Performance when Installed.** The applicant should accomplish a droplet impingement analysis and/or tests to ensure that the ice detector is properly located. The detector and its installation should minimize nuisance warnings.

c. **System Safety Considerations.** The applicant should consult AC 25.1309-1A for guidance on compliance with § 25.1309. In accordance with the AC, the applicant should accomplish a functional hazard assessment to determine the hazard level associated with failure of the ice detection system. If visual cues are not available to indicate repeated cycles of a manually cycled de-icing system, the ice detection system may become primary under § 25.1309. The unannunciated failure of a primary ice detection system is assumed to be a catastrophic failure condition, unless the characteristics of the airplane in icing conditions without activation of the ice protection system(s) are demonstrated to result in a less severe hazard category. If visual cues are primary, failure of an advisory ice detection system is considered to be minor.

d. **Hardware and Software Qualification.** For guidance on hardware and software qualification, the applicant should consult RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification," and RTCA/DO160D, "Environmental Conditions and Test Procedures for Airborne Equipment."

8. COMPLIANCE WITH § 25.1419(g)

Procedures for operation of the IPS should be provided in the AFM as discussed in section 5 and 6 above. Information should be provided to indicate that a de-icing system should not be de-activated until the completion of an entire de-icing cycle after leaving icing conditions. An anti-icing system should not be de-activated before leaving icing conditions.

9. COMPLIANCE WITH § 25.1420

a. **Requirement of the Rule.** Section 25.1420 is applicable to aircraft equipped with reversible flight controls in either the pitch or roll axis. It requires that one of the following must be provided to alert the flight crew that they must exit icing conditions:

- Substantiated visual cues that enable the flightcrew to determine that the airplane is in large droplet conditions conducive to ice accumulation aft of the airframe's protected areas; or
- A system that alerts the flightcrew that the airplane is in large droplet conditions conducive to ice accumulation aft of the airframe's protected areas

b. **Acceptable Means of Determining if Airplane is Operating in Large Droplet Icing Conditions.** There are several acceptable means for determining that the airplane is operating in large droplet conditions conducive to ice accumulation aft of the airframe's protected area. These include:

(1) Direct or Remote Measurement on a Monitored Surface:

(a) *Placement of Detectors.*

(i) For direct measurement, ice detectors are fitted directly onto the surface to be monitored. The detectors sense the presence and/or the thickness of ice that is accumulating aft of the protected area. They are usually flush-mounted (integrated on or within the skin). The monitored surface may vary from a spot of approximately 1 square inch to several square inches or larger.

(ii) For remote measurement, the sensing element is not directly fitted onto the surface to be monitored. An optical means (e.g., infrared or laser devices) may be one means of compliance. The surface extent monitored by this system is usually larger than with direct measurements.

(b) *Ability to Sense Ice*. The applicant should demonstrate that the detector will perform its intended function.

(i) For direct measurement, an icing wind tunnel and/or a laboratory chamber may be used to evaluate the ability of the ice detector to detect ice.

(ii) For remote measurement, laboratory tests may be used to demonstrate the ability of the detector to detect ice on the monitored surface.

(c) *Detector Position.* The detector should be positioned such that it performs its intended function with considerations given to the following factors:

(i) accretion characteristics of the monitored surface,

(ii) sensitivity of the airfoil to ice accretions,

(iii) thermal characteristic of the installation with respect to the generation of heat (direct measurement only),

(iv) physical damage from foreign objects,

(v) early detection (response time),

(vi) not intrusive relative to ice accretion on the monitored surface (direct measurement only),

(vii) field of view relative to the monitored surface (remote measurement only),

(viii) obscuration due to atmospheric conditions (e.g. snow, clouds) (remote measurement only), and

(ix) any other appropriate factors.

(d) *Analysis and icing wind tunnels* may provide information for location of the detector. In addition, laboratory tests may provide information for location of the remote detector.

(2) Remote Measurement Correlated to Ice Accumulation on a Monitored Surface. One method that could be used would be to provide indication of the conditions by discriminating droplet sizes. This method could provide an indication of conditions beyond those for which the airplane has been demonstrated.

(a) *Acceptable Settings.* Unless other acceptable criteria can be established, the device should be set to provide an indication when conditions exceed those specified in Appendix C, assuming a Langmuir E distribution for 50μm MED droplets. (The definition of a Langmuir E distribution can be found in the FAA Technical Report DOT/FAA/CT-88/8-1, "Aircraft Icing Handbook" published March 1991, updated September 1993.) When the device detects conditions that exceed the Appendix C conditions, the "exit icing" signal should be activated.
Note: this paragraph may need revision in light of further information to be developed during task 2.

(b) *Component Qualification.* The component level certification should verify that the uninstalled device is capable of providing a reliable and repeatable signal. One method would be to perform testing in an icing tunnel. The droplet size distribution should bracket the signal point, with droplet distributions slightly below and slightly above the signal point. The test should be repeated at sufficient conditions of liquid water content and ambient temperature to ensure operation throughout the icing conditions defined by Appendix C (of 14 CFR part 25) and with droplet sizes up to 500 microns, or identify limitations as to the conditions where performance is degraded. The applicant must substantiate the acceptability of any equipment limitations.

(3) Visual Means. This means can range from direct observation of ice accretions aft of the airplane's protected surfaces to observation of ice accretions on reference surfaces. Examples of visual means that could indicate to the flightcrew that the airplane is operating in large droplet conditions conducive to ice accumulation aft of the airframe's protected areas include observations of:

- accretions forming on unheated portions of side windows,

- accretions forming on the aft portions of propeller spinners,
- accretions forming on aft portions of radomes, and
- water splashing on the windshields at static temperatures below freezing

(a) *Field of View.* The visual cue should be developed with the following considerations:

(i) Visual cues should be within the flightcrew's vision scan area while seated and performing their normal duties.

(ii) The visual cue should be visible during all modes of operation (day, night).

(b) *Verification.* During the certification process, the applicant should verify the ability of the crew to observe the visual cue and reference surface. The visual cue should not be dependent upon the location of the flightcrew's seats. The visual cue should be evaluated from the most adverse flightcrew seat locations in combination with the range of flightcrew heights, within the approved range of eye reference point locations, if available. The visual cues should be visible from both the left and right seats. Consideration should be given to the difficulty of observing clear ice. If a reference surface is used, the applicant should validate that it correlates with conditions conducive to ice accumulation aft of the airframe's protected areas. Validation of the visual cues may be accomplished by testing in measured natural icing or simulated large droplet icing behind a calibrated water tanker aircraft. However, the low probability of finding conditions conducive to ice accumulation aft of the protected areas may make natural icing flight tests impractical.

c. **System Safety Considerations.** The applicant should consult AC 25.1309-1A for guidance on compliance with §§ 25.1309.

(1) Hazard classification. The following is a qualitative analysis that may be used for determining the hazard classification for compliance with this part 25 regulation. Not all encounters with large droplet icing result in a catastrophic event. While definitive statistics are not available, given the volume of aircraft operations and reported incidents that did not result in a catastrophe, a factor of approximately 1 in 100 is a reasonable assumption of the probability of a catastrophic event, if an airplane encounters large droplet conditions conducive to ice accumulation aft of the airframe's protected areas. Based on the above assumption, the hazard classification of an unannunciated encounter with "large droplet conditions conducive to ice accumulation aft of the airframe's protected areas" may be considered as *severe major* in accordance with AC 25.1309-1A.

(2) Frequency of occurrence. The icing conditions described in Appendix C were designed to include 99 percent of the icing conditions. Evaluation of icing data has indicated that the probability of encountering icing outside of Appendix C droplet

conditions is on the order of 10^{-2}. The applicant may assume this probability for encountering the large droplet conditions conducive to ice accumulation aft of the airframe's protected areas. It should be considered as an average probability throughout the flight.

(3) Numerical safety analysis. For the purposes of a numerical safety analysis, the applicant may combine the probability of equipment failure with the probability, defined above, of encountering large droplet conditions conducive to ice accumulation aft of the airframe's protected areas. Therefore, if the applicant uses the above qualitative analysis for the hazard classification and the above probability of encountering the specified large droplet conditions (10^{-2}), it follows that the probability of an unannunciated equipment failure should be less than 10^{-5}.

d. **System Performance when Installed.**

(1) The ice detector system installed for compliance with § 25.1420 is intended to detect ice that forms due to large supercooled droplets that exceed Appendix C. Flight tests in measured natural icing conditions (required by § 25.1419) should be conducted to ensure that the system does not produce nuisance warnings when operating in conditions defined by Appendix C.

(2) The low probability of finding, for testing purposes, conditions conducive to ice accumulation aft of the protected areas, may make natural icing flight tests impractical as a means of demonstrating the system functions in conditions that exceed Appendix C. The applicant may use flight tests of the airplane under simulated icing conditions (icing tanker) or icing wind tunnel tests of a representative airfoil section to demonstrate the proper functioning of the system and to correlate the signals provided by the detectors and the actual ice accretion on the surface.

NOTE: The measured natural icing flight tests required by § 25.1419 are only applicable for conditions that are defined by Appendix C.

e. **Hardware and Software Qualification.** For guidance on hardware and software qualification, the applicant should consult RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification," and RTCA/DO160D, "Environmental Conditions and Test Procedures for Airborne Equipment."

f. **Airplane Flight Manual**

(1) For ice detector systems, the AFM should address:

- operational use of the ice detection system and any limitations of the system; and
- failure indications and associated crew procedures.

(2) For visual means of compliance, the AFM should contain procedures that describe the visual means used to indicate that the airplane is operating in large droplet conditions that are conducive to ice accumulation aft of the airframe's protected areas.

(3) The following are acceptable AFM changes regarding actions the flightcrew should take after there is an indication of ice aft of the protected areas. Changes to the Limitations Section of the AFM must be approved by the FAA.

(a) Revise the Limitations Section of the FAA-approved AFM to require the pilot in command to immediately take action to exit the conditions where ice accretion is occurring, unless in the opinion of the pilot-in-command, it is necessary to delay such action in the interest of safety.

(b) Revise the Normal Procedures Section of the FAA-approved AFM to include the following:

- In order to avoid extended exposure to flight conditions that result in ice accumulations aft of the protected areas, the pilot in command must immediately take action to exit the conditions in which any ice accretion is occurring, unless in the opinion of the pilot in command, it is necessary to delay such action in the interest of safety.
- Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
- Do not engage the autopilot.
- If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.
- If an unusual roll response or uncommanded roll control movement is observed, smoothly but positively reduce the angle-of-attack.
- Do not extend flaps during extended operation in icing conditions. Operation with flaps extended can result in the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
- If the flaps are extended, do not retract them until the airframe is clear of

ice.

- Report these weather conditions to Air Traffic Control.

- Maintain airspeed awareness and follow minimum speed guidelines per Airplane Flight Manual procedures, including a nose down attitude, if required, to maintain an acceptable airspeed.

Continue to follow these procedures until it can be determined that there are no ice accretions aft of the protected surface.

Transport Airplane Directorate
Aircraft Certification Service